

## COMPUTER AIDED MAP LOCATION SYSTEM

This is a continuation of application Ser. No. 265,327, filed Jun. 24, 1994, now abandoned.

### TECHNICAL FIELD

This invention relates to a new system for correlation and coordination of spatially related data between digital electronic media such as transitory computer displays or other computer outputs, and a variety of graphic and text media such as printed maps and other related "fixed" graphic and text media. The invention also provides for communication of the spatially related data between computer systems and between users in a variety of contexts and combinations. The invention has broad application for visual, intuitive, and other sensory correlation by the user of spatially related data such as location data for locatable objects between a user readable transitory computer display and other computer outputs, and a corresponding user readable printed map or other fixed media presentation of the same spatial area. The invention provides "intelligent" printed maps and other intelligent fixed media maps by incorporation of a digital electronic data dimension for data processing, computation, and communication.

The invention also provides a novel grid system for user correlation of location data and other specified data between the diverse media. The spatially or geographically related data are correlated and coordinated internally by a computer according to the present invention with reference to a common geographical coordinate system such as the standard latitude/longitude location coordinate system. The spatially related data is correlated and coordinated intuitively by the user between human readable forms of the map using the new grid system and uniquely named grid quadrangles of constant scale. The invention permits correlation, coordination and communication of diverse data such as location data, geographical and GIS data, related text and alphanumeric data, mapping data, and visual, auditory, and other sensory data. Data may be derived from any state of the art available inputs to the system either local or remote, internal or external, and the data correlated and coordinated in diverse media according to the invention can be made available in any state of the art outputs and can be communicated to any location.

In a preferred form, the invention relates to a new computer aided map location system (CAMLS) using a coacting personal digital assistant (PDA) or other digital or electronic computer (EC) such as a digital microprocessor based personal computer (PC), workstation, or mainframe, and a set of detailed printed maps depicting surface features or mappable features for a specified geographical area, typically a set of printed paper maps. The PDA/PC/EC can be either stationary or mobile. The PDA/PC/EC permits generalized display of grid quadrangles of a constant scale grid system representing a specified geographical area and any of a selected group of latitude/longitude located objects. The geographical coordinate system located objects include user location, geographical destinations, and other selected geographical objects, from a set of databases stored in PDA/PC/EC memory devices or accessible through wired and wireless data communications links. The geographical objects are displayed on one or more generalized grid quadrangles or tiles of the grid system.

The grid quadrangles coincide in geographical area with respective printed maps or grid quadrangles overlying the

printed maps for correlation of location of geographical objects on the displayed grid quadrangle and corresponding printed map. For example the locations of displayed geographical objects on a user readable transitory computer display are correlated with surface features or mappable features depicted on the corresponding user readable printed map using the grid system. The same constant scale grid systems overlie and coordinate all the diverse media presentations of the same geographical areas. The databases of locatable objects and related information may include for example restaurants, hotels/motels, cities, municipalities, settlements, routes, transportation services such as airports and ferries, parks, recreation areas, campgrounds, hospitals, zoos, museums, tourist and sightseeing attractions, and other geographical landmarks or objects for user selectivity.

The CAMLS is also applicable for use with radio location systems, dead reckoning location systems, and hybrid location systems. For example, the GPS satellite system is used with a GPS receiver for displaying location, travel direction, speed, route, and other traveling data of the CAMLS user on the generalized grid quadrangles for correlation of location with surface features or mappable features on the set of printed maps coinciding with the grid quadrangles. Multiple sets of maps and grid systems at different scales may be interrelated in the CAMLS. The CAMLS system provides "intelligent" printed maps by direct computer output of computed mapping and travel location data on grid quadrangles for correlation with mapped surface features on the corresponding printed maps. This can be accomplished by human senses, e.g. visually and intuitively between human readable forms of the map without the necessity of mentally or quantitatively determining latitude and longitude and without requiring any mathematical calculations by the user. Text and voice or audio outputs can be provided to facilitate use and reading of the printed maps. The invention also adds a communications dimension to the maps for adding and updating the latest spatially related data, for providing software tools for map analysis and reading, and generally for communications between computer systems and between users in a variety of combinations.

### BACKGROUND ART

A hand held personal GPS navigation tool has been developed by Trimble Navigation of Austin, Tex. 78759 under the trademark Scout GPS (TM). The Trimble navigation tool incorporates a GPS receiver and a four line character display for displaying position information in alphanumeric characters. It is stated that this hand held GPS system can display alphanumeric position information in a latitude/longitude coordinate system or a Universal Transverse Mercator (UTM) coordinate system. The Trimble navigation tool can apparently also display proprietary coordinate system information for locating the position of a user on a standard topographic map. The Trimble GPS navigation tool displays in alphanumeric characters the horizontal and vertical coordinate distances of the user from the southeast corner or southeast reference point of any standard topographic map.

A disadvantage of the Trimble GPS navigation tool is that it provides a display of coordinate system data only in alphanumeric characters on a multiline LCD display. The user must then perform mathematical measurements and operations to determine the user location on a particular topographic map. While the incorporation of GPS technology provides an improvement over dead reckoning and position estimation from topography, it necessarily requires user reference to quantitative measurements and calcula-